



# Newsletter

22 August 2016

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*Editorial and  
Organizational  
Development*

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## Editorial

In your hands you have the latest newsletter of our organization. Unfortunately, we had some delays. Originally it was planned to incorporate additional information on geoethics on a regular basis into our newsletter and a first version had already been prepared. Then our counsellor on geoethics decided that he had more urgent needs to disseminate his information and we decided to leave the newsletter as it is – a regular information on member and organizational matters with a dedicated focus on disaster prevention. Nevertheless, I believe that the newsletter comes just in time after the big summer vacation break in Europe and in North America.

Since the last issue many of our members have been active in different areas reaching from public hearings to scientific discussions.

We had also our first General Assembly Meeting discussing our next actions and the development of our organization. The draft bylaws are completed and will be sent out for discussion to the Editorial Committee assigned to do the final editing in September. So we have progressed and been active despite that most of the work has to be managed by a few volunteers. We will give a short overview on the most important items.

## Organizational Development

### General assembly meeting:

The first General Assembly Meeting took place on April, 21<sup>st</sup>, 2016 in Vienna. This was the first meeting in compliance with our revised organizational format. It appeared to be difficult for many of our members to get to the meeting, nevertheless we had fruitful discussions. We actively discussed our next actions. One of the important issues discussed is the development of a scientific strategy in seismology which is explained below in the newsletter. The minutes of meeting have been distributed to all members and observers.

**Website:** [www.issquake.org](http://www.issquake.org)

Thanks to the efforts of our Secretary General, Liana Mualchin, we were able to move the website from Italy to the U.S. With the support of Indra and his family we started the renovation of the website and we will continue step by step. We are still looking for a webmaster to coordinate the work that needs to be done on a volunteer basis.

**Bylaws:** Due to some delay (at the moment we were not able to complete the assignment of all our board positions) we were slowed down with our action plan, but we still move steadily forward. The name of ISSO is registered as an official organization to EGU now.

**New members:** Dr. Ehsan Noroozi associated with Kerman Graduate University of Advanced Technology [KGUT], Qazvin Islamic Azad University [QIAU] and International Institute of Earthquake Engineering and Seismology [IIEES] in Earthquake Engineering, all in Iran.

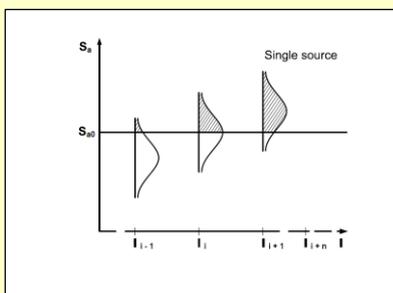
## Scientific Strategy

ISSO members discussed several ideas how to get a better link between seismology and earthquake engineering. In compliance with our position paper we want to prepare the society to be prepared for the worst possible event that can be supported by science. A reasonable way to promote this Intention consists in the support of the use of seismic intensities in hazard analysis. This addresses one of the key weaknesses of PSHA – the use of inadequate engineering parameters to characterize the consequences of earthquakes. The sole use of ground motion accelerations and uniform hazard spectra is not suitable to describe the damaging effects of earthquakes. At least additional information on seismic energy or strong motion duration is needed to evaluate these effects. This is necessary because the latter effects are nonlinear. Additionally, a uniform hazard spectrum in terms of ground motion accelerations does not specify the consequences of earthquakes uniquely. Low magnitude events with insignificant seismic energy statistically (if the aleatory variability is included as it is done in the PSHA hazard integral) may lead to the same spectra (same UHS) like large magnitude events but the damaging effects are very much different. And this was the original idea of PSHA to reduce the seismic hazard for the nuclear power plant Diablo Canyon in California using the camouflage of high spectra. It is a camouflage in the best tradition of Sun Tzu's art of war - keeping the formal image of a matter but changing its content. Here the common belief is misused that accelerations are causing damage, ignoring the fact that this is only true if the causing event has sufficient energy. By providing a link between engineering parameters and site intensities (or intensity factors) this ignored link can be re-established. This prevents the "hidden replacement of big earthquakes by minor earthquakes with elevated spectra" taking place in PSHA leading to a large reduction of seismic hazard. This is because in modern earthquake engineering the low energy content of the PSHA hazard is taken into account by engineers leading to reduced design provisions (e.g. using diverse response or ductility factors). The link between intensity and engineering parameters needed for practical computations can be provided by associating intensities with calibrated time series either recorded ones or developed by waveform modelling like the NDSHA method. ISSO members discussed this topic in a special meeting with Non-ISSO members during the EGU meeting in Vienna. Some first presentations were made during the EGU meeting, and some other presentations will be made at the 16<sup>th</sup> WCEEE meeting in Chile. The conceptual idea of linking intensities with earthquake engineering consists in the development of a damage-consistent performance-based approach to the design of structures and systems. This concept will open space for new academic and engineering research promoting the replacement of subjective expert judgment and crude data manipulations by physics-based methods and serious research. The most important value of this strategy is that "pseudo-intellectual" discussions about uncertainties are replaced by empirical observations related to the true consequences of earthquakes. Large magnitude and therefore high energy earthquakes cause more damage than small ones even if the latter may lead to elevated spectra due to wave amplifications resulting from directional and topographical effects. A return to intensities is reasonable even if linked to a probabilistic assessment, but it shall never be forgotten that probabilistic hazard assessments serve a sole purpose – risk assessment. The task of risk assessment is to distinguish between (believed) tolerable residual risk and non-tolerable risk. Risk assessment is therefore not able to prevent disasters resulting from extremes. Extremes are typically screened out due to the assumed low frequency of their occurrence. Physics-based approaches based on the worst possible event serve disaster prevention and have therefore a different objective.

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### Scientific Strategy of ISSO

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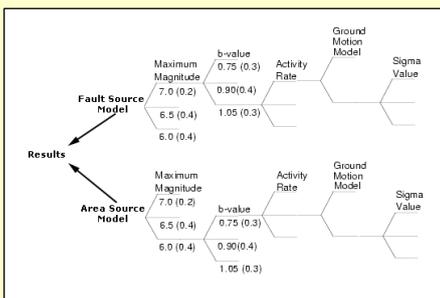


*Uniform Hazard Spectrum of PSHA – combining earthquakes of different intensities (exceeding a spectral acceleration  $S_a$ ) as equally important into one spectrum – this is how PSHA is diluting hazard estimates in active areas by incorporating weak earthquakes into design spectra*

## New Seismic Hazard for Swiss Nuclear Power Plants – ENSI-2015 – “How to make up a seismic hazard”

### ENSI-2015 How to make-up a seismic hazard

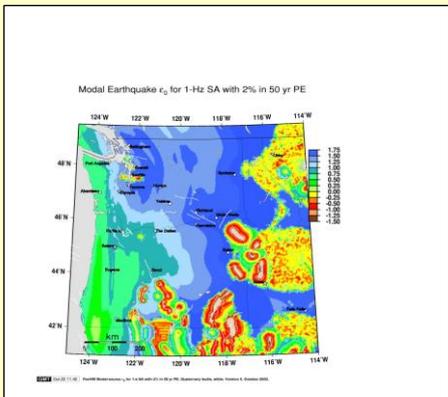
Many members of ISSO are familiar with large scale PSHA study approaches based on logic trees and subjective expert judgement used for the characterization of random uncertainty (aleatory variability) and lack of knowledge (epistemic uncertainty). The most advanced studies are following the US NRC SSHAC procedures with the level 4 of expert judgement being the most elaborate level (NUREG-CR-6372). *Here the experts are allowed to overrule data and/or any other type of scientific information replacing it by subjective opinion.* The intention is that the pool of experts 'opinion reflects the centre, body and range of knowledge of the technically informed community. Because experts are human beings and earth scientists are not universal geniuses in all areas of science and engineering, this approach poses many practical problems - technical, psychological and simply economical. It is worth to mention that for some strange reasons the set of experts that is involved in such studies (especially the technical facilitators, TFIs) and thus is regarded to be representative for the technically informed community is very limited. It is important to underline the position of ISSO, that such subjective methods that are vulnerable to human biases and more importantly to motivational bias (triggered possibly by economic interests) are not acceptable and do not comply with the interests of public safety.



Example – Logic tree for seismic sources in a PSHA – such a tree was modified after the review of PRP to incorporate the historical earthquake of Basel (1356)

The PEGASOS project and the follow-up PEGASOS Refinement Project (PRP) were performed in accordance to the SSHAC guidelines for level 4 for the sites of Swiss nuclear power plants. The project was paid for and finally also managed by the Swiss Nuclear Industry based on a requirement of the Swiss Nuclear Authority (ENSI, formerly HSK). The project was launched (first draft project plan) in 1998 and completed (the PRP) by the end of 2013. The whole process was accompanied by a participatory review team led by ENSI, Swiss Seismological Survey SED (D. Giardini), US-based expert R. Sewell, and a Swiss consultancy company, Basler & Hofmann). The PEGASOS-project and its follow-ups were the largest and the only real SSHAC level 4 study ever completed. The sister study for the Yucca Mountain radioactive waste repository in the USA was abandoned after the presidential elections of 2008.

Although the PRP project was performed in full accordance with the requirements of ENSI outlined before the project (the project plan was confirmed by ENSI) the results of the 2013 study were reviewed again (again by SED and ENSI) and not accepted. This non-acceptance by ENSI has a sound basis that complies with the interests of ISSO. It was found that the uniform hazard spectrum (UHS) for a frequency of exceedance of  $10^{-4}/a$  of the PRP study does not reflect the known historical seismicity especially associated with the Basel region. Such a conclusion can be made using the deaggregation results in terms of the three-variate hazard background distribution (in terms of  $M$ ,  $D$ , and  $\epsilon$ ). As a result, the reviewers decided to replace the weights in the logic tree for the subproject 1 (seismic sources) for the maximum magnitude for the Basel seismic zone to reflect the higher importance of this area. By doing this they replaced the lognormal distribution suggested by the experts – the owners of the study according to the SSHAC procedures – by a different model that was not even specified.



Colored pictures – Camouflage in PSHA  
- Sun Tzu's art of war



Getting paid twice – ready for the next deal?

Other news

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11th International Conference on Earthquake Resistant Engineering Structures

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This is of course a crude violation from the SSHAC procedures. From the physical point of view this approach is understandable. It simply means that proponents of PSHA have now learned that PSHA is underestimating the importance of large earthquakes resulting from active faults. There is no doubt, that in the Basel region and near the Upper Rhine Graben there is some possibility of larger earthquakes exceeding magnitude 6.5. Any hazard assessment method shall take this into account.

The fact, that the PRP results had to be modified (the new study is called hybrid model or ENSI-2015) to address the well-known historical event from Basel 1356, has to be **regarded simply as an acknowledgement that traditional PSHA has completely failed as a method.** Essentially now the hazard is dominated by the insights from deterministic analysis, from historical data and paleo-seismology associated with some empirical information on ground motion attenuation in Switzerland. Therefore, the final results of ENSI-2015 are very close to deterministic studies and as a consequence the results look to be conservative enough for disaster prevention. But is such an approach science? Is PSHA science? Certainly not!

To construct seismic hazard curves that envelope the typical results of a SSHAC type PSHA an educated person needs only a single data point (frequency of exceedance, and site intensity or pga) and shear wave velocity Vs30 of the site. Within 2 hours it is possible to construct the required hazard curves and even a UHS. The editor has done this and provided a "provocative" lecture on this topic during the last EGU meeting (**PSHA for Dummies**). So for what the industry is paying money here? Again all the coloured paper presented in reports is just a camouflage in the best tradition of Sun Tzu's art of war. In this sense PSHA is a great master piece, but it is certainly not suitable to ensure public safety in case of natural disasters.

The approach taken by the SED raises also many ethical questions, similarly to the behaviour of some seismologists in the aftermath of the L'Aquila trial. First the SED experts got paid for providing the input information to the PEGASOS and to the PRP study, and some of them even got paid as an expert in the study (for example S. Wiemer, the current head of SED). Then they got paid by ENSI to refute their own models and data. There shouldn't be any doubt that they are now ready to refine the study again.

## Other news

The owners of the nuclear power plant Diablo Canyon – PG&E – have decided to abandon their project of license renewal, although NRC would have granted it. The main driver is certainly the economics. Other sources of energy are cheaper today and look to be "greener" and less controversial. So the plant that once created the long term seismic program and sponsored many of the seismic studies in the region and world-wide will be closed about 2024 after 4 years of operation. Let's hope that the big one will not occur beforehand.

For earthquake engineers and engineering seismologists among the ISSO members it may be of interest that next year another ERES conference is organized by the WESSEX Institute of Technology ERES 2017 in Alicante (July 5<sup>th</sup> to 7<sup>th</sup>). The call for papers is opened. It is an interest opportunity for the exchange of opinion between engineering seismologists and structural engineers.